

SPONSOR AND CONTACT INFORMATION

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I hereby certify that, to the best of my knowledge, all statements made in this sponsorship are true. I understand that the information provided (with the exception of detailed specimen locations) will be made public and attributed to me by the California Lichen Society's Conservation Committee, however I am welcome to publish all or part of this information in other avenues as well.

Signature: _____ Date: _____

EXECUTIVE SUMMARY

Solorina spongiosa is mainly a boreal species widely distributed around the Northern Hemisphere, though it also has been found in southernmost South America and Antarctica. In North America, scattered disjunct populations are known from the southwestern United States. Genetic diversity is thought to promote long-term persistence of species and recent studies on lichen genetics in relation to biogeography suggest regions that maintain a species through glacial periods (generally the southern regions) are more genetically diverse than regions the species has recently returned to. Thus the southern disjunctive populations of this species may be of particular conservation value. These populations are all on federally administered lands with high potential for conservation management. However, the habitat of the lichen in the arid southwest (perennially damp seeps and springs) are particularly attractive to recreationists and livestock, thus these habitats are vulnerable to trampling. One Nevada site is also included in a proposed expansion of a ski resort. Recommended ranks are G4G5.3, AZ-S1.2, CA-S1.2, NV-S1.1, UT-S2?.2 and list 2 for all four states (rare in state, more common elsewhere).

TAXONOMY

accepted scientific name

Solorina spongiosa (Ach.) Anzi,

According to Nash et al. 2004 (but see quote under type specimen), name published in *Lichenes rariores Longobardi exsiccati* 2: 46 (1861). Basionym: *Collema spongiosum* Ach., *Lichenographia universalis*: 661 (1810).

common name

fringed chocolate chip lichen

type specimen and location, if known to you

From Roland Moberg, curator of the lichen herbarium in Uppsala, Sweden: "There is no material in UPS of *Solorina spongiosa* that could be used as type. According to Acharius (Lich. Univ.)

the type is Fig. 1374 in English Botany (1805) and he has seen no material of the species. Actually Acharius validated *Lichen spongiosus* in the genus *Solorina*. This will be published in Vol. 3 of Nordic Lichen Flora.”

synonyms

Collema spongiosum

Lichen spongiosus

description (with citations if applicable)

Based on Beyer & St. Clair (2004), who assembled the description from a variety of literature. Apparent thallus squamulose to granular, often corralloid, greenish to grayish brown, formed of cephalodia containing *Nostoc* cyanobacteria, surrounding large urceolate (deeply concave) dark reddish brown apothecia. A true thallus with green algae (*Coccomyxa*) is reduced to a thin ring around the apothecia. Apothecia and squamules have rhizines on the underside, which attach the thallus to the substrate. Apothecia up to 10 mm diameter though rarely over 5 mm diameter in most populations. Hymenium hyaline; paraphyses unbranched and coherent with the tips red-brown and slightly thickened. Ascospores brown, 1-septate, 4 per ascus, huge, 30 – 50 X 18 – 22 µm, with a warted, furrowed surface. Occurring on mosses over soil (or rarely directly on rock or soil) in areas that are nearly perennially damp, in arctic, alpine, or subalpine, calcareous habitats. In the southwest, high altitude seepage sites with a cool, northerly or easterly exposure, appear to be the primary habitat. See photos in Beyer & St. Clair (2004) and Brodo et al. (2001).

similar species and distinguishing characteristics

This is a very distinctive species. The thallus is superficially similar to some species in the Pannariaceae, but the apothecia are quite distinct from any in that family. The apothecia resemble other members of the genus *Solorina*, but the thallus clearly differs as all others have a much better developed true thallus and cephalodia are quite restricted.

biological characteristics:

growth form: sub-foliose (nearly crustose), on mosses over soil

reproductive method: sexual by spores from apothecia

dispersal agents: unknown, possibly wind or invertebrates

substrate and specificity: almost entirely restricted to mosses over calcareous soil

habitat and specificity: strongly specific to arctic, alpine and subalpine

pollution sensitivity: unknown; air pollution deposited by snowfall likely has the greatest impact.

ecological function: nitrogen fixation, likely a food source for invertebrates

GEOGRAPHY, GLOBAL

Known from cooler or higher elevation portions of Europe, Japan (and presumably Asia), and North America. Also known from the New Zealand, southernmost South America, and Antarctica. In North America (see Brodo et al. 2001; McCune & Geiser 1997) it is most broadly distributed in Alaska and Yukon, with a few geographically broad populations scattered across Canada. The western portion of its range (which includes Alaska and Yukon) extends southward

in the Rockies and Cascades into the continuous United States and a handful of disjunct populations are known in the southwest.

GEOGRAPHY, LOCAL

See attached map. In western North America, the primary range extends southward from arctic/boreal climates in the Rockies to Montana or possibly into Yellowstone National Park, Wyoming and in the Cascades to Washington. A small number of isolated, disjunct populations are known from the southern Rockies and various other ranges in the west (see map; Arizona, California – southern Sierra Nevada, Oregon – Wallowa [as reported by John Villella in a discussion at <http://discussions.crustose.net>], Nevada – Spring Mountains, New Mexico, and Utah – Uintah Range). These isolated disjunctive populations are, presumably relictual within a refugial region for the species during glacial periods of the Pleistocene. Genetic research on widespread lichens suggests refugial regions are likely harbor the greatest genetic diversity within lichen species (Printzen et al. 2003). Since this species is uniformly apotheciate but lacks spermatia, it likely is capable of selfing (Murtagh et al. 2000), unlike facultatively apotheciate species with frequent spermatia, which are likely obligate outcrossers (Zoller et al. 1999). Thus genetic diversity is probably low within isolated populations but may be quite high among isolated populations – emphasizing the importance of preserving most, if not all, populations within the southwestern United States.

POPULATION TRENDS

Populations in Europe likely have experienced some decline due to direct land development, change in microhabitat due to logging, or trampling by people or livestock. In North America, logging of boreal forests may have caused some declines. Otherwise it is unlikely that populations in North America have experienced significant declines, as they tend to be at higher latitudes or elevations where anthropogenic disturbance is minimal. However, the primary range of the species is in the high latitudes which are covered by ice during glacial periods. Those areas may be genetically depauperate in temperate to arctic lichen species (Printzen et al. 2003) and may be of low importance for maintaining the genetic integrity of a species relative to southern, refugial areas, which likely have been contracting since the last glacial period.

THREATS, HISTORY

Globally, logging is probably the greatest threat. In the southwestern U.S., trampling by recreating people, and livestock is the greatest threat.

THREATS, FUTURE

All actions listed as historical threats (above) remain as current threats, with the partial exception that improvements in logging and livestock grazing practices have reduced, but not eliminated, threats. Human recreation is increasing in the area of the Nevada population and possibly other populations in the southwest. Climatic warming could also be a significant future threat as most southwestern populations have little or no opportunity to extend themselves to higher elevations

due to lack of appropriate seepage sites or simply that they are already near the top of the mountains.

PROTECTION

S. spongiosa has the following listings:

- * The Red List of Estonian Lichens under category 4, “care demanding species” (http://www.ut.ee/lichens/red_list.html).
- * The Red List of Threatened Lichens of Japan as “threatened” (http://www.biodic.go.jp/english/rdb/red_lichens.csv)
- * The Redlist for Denmark as “acutely threatened” (<http://www.skovognatur.dk/netpub/rodliste/72.htm>)
- * The Alberta Natural Heritage Information Centre as “S2” (Natural Heritage methodology). (http://www.casebio.com/lichens/lichen_list.pdf).
- * The Montana Natural Heritage Program as “S1” (Natural Heritage methodology) (http://nhp.nris.state.mt.us/plants/reports/2003_PSoC_List.pdf) (note: this list appears to be preliminary with many under-collected species).

CONSERVATION STATUS SUMMARY

This is an arctic/boreal species with disjunctive populations sprinkled southward in high calcareous mountains of the southwestern united states. The species is demonstrably secure from extinction for the foreseeable future. However, the disjunct, presumably glacial refugium populations in the southwestern United States are vulnerable to anthropogenic disturbance. Genetic diversity for the species may be greatest among these refugial populations. Care should be taken to avoid disturbance of these populations. Tracking of the known populations by Natural Heritage Programs in the region will help reduce the likelihood of disturbance.

SPECIFIC CONSERVATION RECOMMENDATIONS

No recommendations are made here for the state of Oregon; it is entrusted that the Northwest Lichenologists will make any proposals they deem appropriate.

Recommended Global Rarity Rank: G4G5

Although the range is quite large, frequency of occurrence within that range is still largely unknown.

Recommended Global Threat Rank: 3

Much of the range of this lichen is unlikely to be significantly disturbed in the foreseeable future.

Recommended Local Rarity Rank(s) (per state): AZ 1; CA 1; NV 1; UT 2?

Reasoning, if necessary

Recommended Local Threat Rank(s) (per state): AZ 2; CA 2; NV 1; UT 2

Known locations are on public land with presumably some degree of management for conservation. However, this lichen inhabits mosses over soil in near-perennially damp areas

such as seeps, thus it is highly vulnerable to trampling by recreationists or stray livestock. Furthermore, one site in Nevada is adjacent to the Lee Canyon Ski and Summer Resort, which is seeking to expand. The populations may also be vulnerable to climatic change.

Recommended List(s) (CNPS equivalent, per state):

AZ: 2

CA: 2

NV: 2

UT: 2

Recommended conservation/management actions:

Awareness of the disjunct populations would increase protection of the site from anthropogenic disturbance, therefore tracking by Natural Heritage Programs in the southwestern U.S. is recommended. Trail realignments and fencing where appropriate may also reduce the likelihood of disturbance by trampling. The sites should be periodically monitored to determine persistence of the population.

RELEVANT EXPERTS AND KNOWLEDGABLE LOCAL BOTANISTS

Dr. Larry St. Clair – Lichenologist
Brigham-Young University
M.L. Bean Life Science Museum
Provo, UT 84602
Phone: 801-422-2582

Dr. Tom Nash III – Lichenologist
School of Life Sciences
P.O. Box 87 4501
Tempe, AZ 85287 – 4501
Phone: 480-965-7735

Cheryl Beyer – Forest Service botanist, found southern NV location
Modoc National Forest
800 West 12th Street
Alturas, California 96101
Phone 530-233-8809

Dr. Bruce McCune – Lichenologist
Dept. Botany and Plant Pathology
Cordley 2082
Corvallis, OR 97331
Phone: 541-737-1741

STAKEHOLDERS FOR NOTIFICATION OF COMMENT PERIOD

Arizona Heritage Data Management System

Arizona Game & Fish Department
2221 W. Greenway Rd.
Phoenix, AZ 85023

California Dept Fish and Game
Attn: Bittman, Roxanne – CNDDDB lead botanist
Wildlife & Habitat Analysis Branch
1807 13th Street Suite 2002
Sacramento, CA 95814

Nevada Natural Heritage Program
Attn: Jim Morefield
901 South Stewart St. #5002
Carson City, NV 89701

Utah Conservation Data Center
Utah Division of Wildlife Resources
Attn: Ben Franklin
1594 West North Temple, Suite 2110
Box 146301
Salt Lake City , UT , 84114-6301 , USA

Apache-Sitgreaves National Forests
P.O. Box 640
Springerville, AZ 85938

Humboldt-Toiyabe N.F.
Attn: Joanne Baggs
1200 Franklin Way
Sparks, NV 89431

Inyo National Forest
351 Pacu Lane
Suite 200
Bishop, CA 93514

Uinta National Forest
88 West 100 North
PO Box 1428
Provo UT 84601

LITERATURE (cited or otherwise relevant)

Beyer, C. and L. St. Clair. 2004. *Solorina spongiosa*: a new species record for Nevada. Bulletin of the California Lichen Society 11: 1-6.

Brodo, I. M., S. D. Sharnoff, and S. Sharnoff. 2001. Lichens of North America. Yale University Press.

McCune, B. and L. Geiser. 1997. Macrolichens of the Pacific Northwest. Oregon State University Press.

Murtagh, G. J., P. S. Dyer, and P. D. Crittenden. 2000. Sex and the single lichen. Nature 404: 564.

Nash, T. H. III, B. D. Ryan, P. Diederich, C. Gries, and F. Bungartz. 2004. Lichen Flora of the Greater Sonoran Desert Region. Volume 2.

Printzen, C., S. Ekman, and T. Tønsberg. 2003. Phylogeography of *Cavernularia hultenii*: evidence of slow genetic drift in a widely disjunct lichen. Molecular Ecology 12: 1473-1486.

Smith, R. I. L. & Øvstedal, D. O. 1994: *Solorina spongiosa* in Antarctica: an extremely disjunct bipolar lichen. - *Lichenologist* **26(2)**: 209-213.

Zoller, S., F. Lutzoni, and C. Scheidegger. 1999. Genetic variation within and among populations of the threatened lichen *Lobaria pulmonaria* in Switzerland and implications for its conservation. Molecular Ecology 8: 2049-2059.

LOCATION/SPECIMEN LIST

Arizona

Apache Co.; [... data omitted from public version]

California

Inyo Co.; [... data omitted from public version]

Nevada

Clark Co.; [... data omitted from public version]

report without collection Clark Co.; [... data omitted from public version]

Utah

Geographic coordinates and elevation not given; Allsop Lake Basin [... data omitted from public version]

Geographic coordinates not given; Allsop Lake Basin [... data omitted from public version]

Geographic coordinates not given; East Fork Bear River [... data omitted from public version]

Geographic coordinates not given; High Uintahs, [... data omitted from public version]

